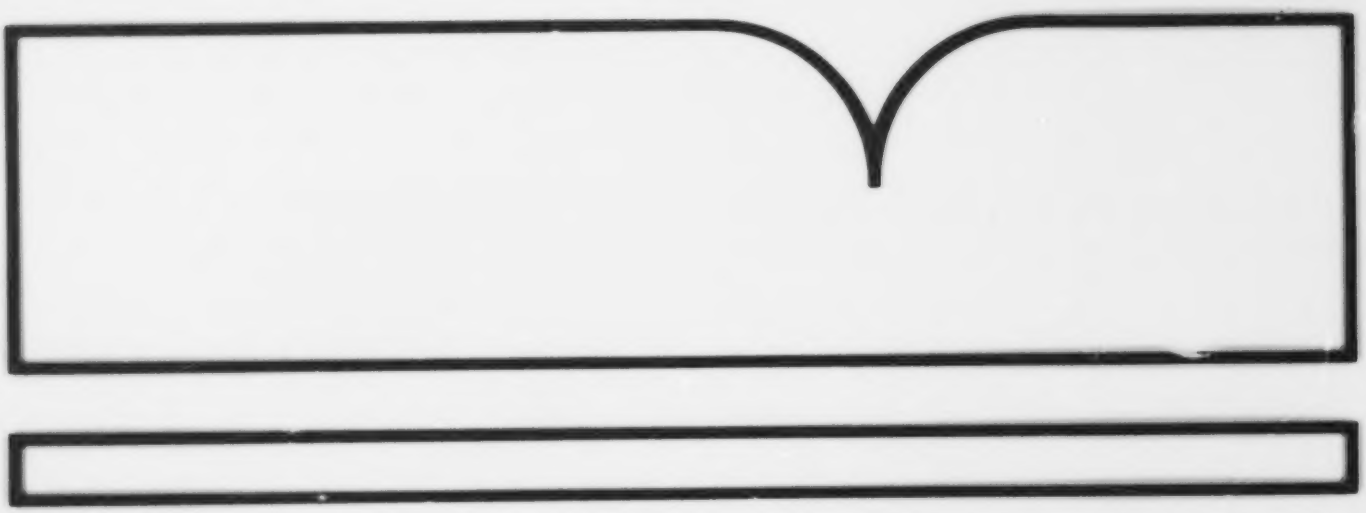
PB88-216874

Pesticide Fact Sheet Number 158
Allethrin Stereoisomers

(U.S.) Environmental Protection Agency
Washington, DC

24 Mar 88



U.S. Department of Commerce
National Technical Information Service
NTIS

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO.	2.	3. PB88-216874
4. Title and Subtitle EPA Pesticide Fact Sheets - Allethrin Stereoisomers No. 158			5. Report Date March 24, 1988 6.
7. Author(s) EPA, Office of Pesticide Programs, Registration Division			8. Performing Organization Rept. No. 540/FS-88-064
9. Performing Organization Name and Address U.S. Environmental Protection Agency Office of Pesticide Programs Registration Division (TS-767C) 401 M Street, SW Washington, D.C. 20460			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address Same as #9			13. Type of Report & Period Covered 14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

This document contains up-to-date chemical information, including a summary of the Agency's regulatory position and rationale, on a specific pesticide or group of pesticides. A Fact Sheet is issued after one of the the following actions has occurred.

1. Issuance or reissuance of a registration standard,
2. Issuance of each special review document,
3. Registration of a significantly changed use pattern,
4. Registration of a new chemical, or
5. An immediate need for information to resolve controversial issues relating to a specific chemical or use pattern.

17. Document Analysis a. Descriptors

Pesticides, regulations, Chemical Information Fact Sheet, Use Patterns, science findings.

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
SPRINGFIELD, VA. 22161

18. Availability Statement:	19. Security Class (This Report)	21. No. of Pages
Publicly Available	Unclassified	10
	20. Security Class (This Page) Unclassified	22. Price

United States
Environmental Protection
Agency

Office of Pesticides and Toxic Substances
Office of Pesticide Programs (TS-766C)
Washington, DC 20460

540/FS-88-064

EPA

Pesticide Fact Sheet

Name of Chemical: ALLETHRIN STEREOISOMERS
Reason for Issuance: REGISTRATION STANDARD
Date Issued: March 24. 1988
Fact Sheet Number: 158

1. DESCRIPTION OF CHEMICALS

The following chemicals are all synthetic pyrethroid insecticides. That is, they are synthetic duplicates of a component of pyrethrum which is extracted from chrysanthemum flowers. Introduced in 1949, Allethrin was the first synthetic pyrethroid. Bioallethrin and S-bioallethrin were introduced in 1969 and 1972, respectively

A. Common Name: Allethrin
Generic Name: (2-methyl-1-properyl) - 2-methyl-4-oxo-3-(2 properyl)-2-cyclo-penten-1-yl ester or mixture of cis and trans isomers.
Trade Name: Pynamin
EPA Shaughnessy code: 004001 and 004002 (allethrin coil)
Chemical Abstracts Service (CAS) Number: 584-79-2
Producers: McLaughlin Gormley King
Sumitomo Chemical Company
Fairfield American

B. Common Name: d-trans Allethrin, Bioallethrin
Generic Name: d-trans-chrysanthemum monocarboxylic ester of d 1-2-allyl-4-hydroxy-3-methyl-2-cyclo-penten-1-one
Trade Name: Bioallethrin
EPA Shaughnessy Code: 004003
Chemical Abstracts Service (CAS) Number: 584-79-2
Producers: McLaughlin Gormley King
Roussel Uclaf

C. Common Name: S-bioallethrin; Esbiol
Generic Name: d-trans-chrysanthemum monocarboxylic acid ester of d-2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one
Trade Name: Esbiol
EPA Shaughnessy Code: 004004
Chemical Abstracts Service (CAS) Number: 28434-00-6
Producers: McLaughlin Gormley King
Roussel Uclaf

D. Common Name: D-cis/trans allethrin; Pynamin Forte
Generic Name: dl-3-allyl-2-methyl-4-oxo-2-cyclopentenyl d-cis/trans chrysanthemate
Trade Name: Pynamin Forte
EPA Shaughnessy Code: 004005
Chemical Abstracts Service (CAS) Number: 42534-61-2
Producers: Sumitomo Chemical Co., Ltd.

2. USE PATTERNS AND FORMULATIONS

Application Sites: Broad spectrum insecticides and acaricides registered for use on terrestrial food crops (vegetables, citrus fruits, and orchard crops); terrestrial nonfood uses (ornamental plants, turf, recreational areas, and forest trees); greenhouse food and nonfood crops (ornamentals and vegetables); indoor and outdoor domestic dwellings; postharvest use on fruit, vegetables and grains, and stored food; commercial and industrial uses (food handling establishments).

Types of Formulations: Pressurized liquids, mosquito coils, dusts, emusifiable concentrates, soluble concentrate liquids, and ready-to-use liquids. Almost always formulated with a synergist and one or more additional active ingredients.

Predominant uses and Methods of Application: Primarily indoor and outdoor use around the home as foggers, plant, carpet and general purpose aerosols, and mosquito coils to control common pests including, but not limited to, ants, bedbugs, carpet beetles, cockroaches, fleas, ticks, moths, wasps and bees. Applied to crops foliarly by aerial or ground equipment. Postharvest applications made as an emulsive dip.

3. SCIENCE FINDINGS

Summary Science Statement

The Agency has very little acceptable toxicity data for the allethrin stereoisomers. There are no data available to assess the environmental fate characteristics of these compounds, including their potential to contaminate ground water. There are ecological effects data which show that the stereoisomers are highly toxic to fish and aquatic invertebrates, and essentially non-toxic to avian species. There are no acceptable residue data available to assess the adequacy of the current tolerances for allethrin.

Chemical Characteristics of the Technical Material

Physical State: Viscous oil; liquid, clear oil

Color: Pale yellow, yellow-orange, slightly brownish

Odor: Mild to slightly aromatic

Molecular weight and empirical formula: 302 - $C_{19}H_{26}O_3$

Solubility: Insoluble in water; miscible with petroleum oils, and soluble in paraffinic and aromatic hydrocarbons

Toxicology Characteristics

Acute toxicity: The acute oral toxicity of bioallethrin and and s-bioallethrin is low to moderate. Adequate data to discern other acute effects of these compounds are not available.

Subchronic toxicity: In a 90-day feeding study on bioallethrin, rats were administered 0, 500, 1500, 5000, and 10,000 ppm bioallethrin in the diet. A no-observed-effect-level (NOEL) was established at 1500 ppm based upon a decrease in body weight gain and increased levels of serum liver enzymes in females and increased liver weights in both sexes. This study, however, is presently classified as only supplementary, but may be upgraded upon submission of additional information.

Chronic toxicity: In a 6-month oral feeding study using beagle dogs, the animals were administered 0, 200, 1000, and 5000 ppm bioallethrin in the diet. The NOEL was determined to be 200 ppm based on effects on the liver.

One rodent chronic feeding/oncogenicity study is available for d-cis/trans allethrin. In this study, rats were fed 0, 125, 500, and 2000 ppm of the test substance in the diet for 2 years. No oncogenic effects were observed. For systemic toxicity, the NOEL was determined to be 125 ppm based on decreased body weight gain and the presence of liver effects.

Teratogenicity: One teratology study conducted with bioallethrin is available. In this study, rats were dosed with 50, 125, and 195 mg/kg/day bioallethrin in the diet. The test compound did not induce developmental effects at the dose levels tested.

Mutagenicity: Two mutagenicity studies (DNA damage and reverse mutation) conducted with bioallethrin are negative for genetic damage.

Environmental Fate Characteristics

No data on the allethrin stereoisomers are available to assess the environmental fate and transport, and the potential exposure of humans and nontarget organisms. The potential of these compounds to contaminate ground water is unknown. Because the allethrins are thought to degrade rapidly in the environment, environmental fate data are being required on a "tiered" basis. This approach will permit the Agency to make a preliminary assessment of the persistence of these compounds. The requirement for additional testing will be deferred until evaluation of all data submitted under Tier I.

Ecological Characteristics

Avian Acute Oral Toxicity:

Species	Stereoisomer	LD_{50} or LC_{50}
Mallard Duck	Technical allethrin	>2000 mg/kg
Mallard Duck	D-cis/trans allethrin	5620 ppm
Bobwhite Quail	Bioallethrin	2030 ppm
Bobwhite Quail	D-cis/trans allethrin	5620 ppm

These data show that the allethrins are practically nontoxic to birds on both an acute and subacute exposure basis.

Freshwater Fish Acute Toxicity: Twenty-seven toxicity tests conducted with coldwater and warmwater fish species indicate that the allethrins are highly toxic to fish. The LC_{50} values ranged from 2.6 ppb (coho salmon -- bioallethrin) to 80 ppb (fathead minnow — S-bioallethrin).

Toxicity to Aquatic Invertebrates: Data show that allethrin is highly toxic to aquatic invertebrates with LC_{50} values of 5.6 ppb for stoneflies and 56 ppb for blackflies.

Toxicity to Non-target Insects: Although technical allethrin is moderately toxic to honey bees, the outdoor application rates are so low that even a direct application to bees is not likely to result in significant mortality.

Tolerance Assessment

The available data reviewed are insufficient to evaluate the adequacy of the established tolerances (covering postharvest use) for residues of allethrin in or on food/feed items (40 CFR 180.113). Allethrin is the only stereoisomer with established tolerances.

Because of insufficient residue chemistry and toxicity data for all of the allethrin stereoisomers, the Agency is unable to calculate an acceptable daily intake under the Tolerance Assessment System.

There are no Canadian or Mexican tolerances or Codex Maximum Residue Limits for residues of the allethrins in or on any plant commodity. Therefore, no compatibility questions exist.

4. REQUIRED UNIQUE LABELING

The Registration Standard for the allethrins contains no unique labeling requirements. It requires only updated environmental precautionary and disposal statements and a statement for outdoor use products that the product is highly toxic to fish.

5. SUMMARY OF REGULATORY POSITIONS AND RATIONALES

- The Agency is not starting a special review the allethrins.
- Since EPA believes that the allethrins may degrade rapidly in the environment, the Agency is requiring environmental fate data on a tiered basis. Additional data may be required upon evaluation of the tier I studies.
- The Agency is permitting registrants to use the technical product Esbiothrin as a respresentative test material for chronic studies on Bioallethrin and S-bioallethrin since it is a mixture of the two compounds, and they are of similar toxicity. Separate chronic studies are being required for Allethrin and D-cis/trans allethrin.
- The Agency is not requiring any endangered species restrictions since there is no evidence that the allethrins pose a hazard to endangered species from domestic indoor/outdoor uses.

*The Agency is not requiring any ground water advisory labeling, or reentry, spray drift, or protective clothing restrictions at this time.

*The Agency is not imposing restricted use classification on the allethrins.

*While the required data are under development all currently registered products containing the allethrins may be sold, distributed, formulated and used, provided that they are in compliance with all other terms specified in the Registration Standard.

6. SUMMARY OF MAJOR DATA GAPS

Toxicology

Acute Toxicity:

Acute oral LD_{50} toxicity (Allethrin, Pynamin-forte)
Acute dermal LD_{50} toxicity (Allethrin, Pynamin-forte, S-bioallethrin, Bioallethrin)
Acute inhalation LC_{50} Toxicity (all allethrins)
Eye irritation (all allethrins except Esbiothrin)
Dermal irritation (all allethrins except Esbiothrin)
Dermal sensitization (all allethrins)

Subchronic Toxicity

90-day feeding
  Rodent (all allethrins except Pynamin-forte)
  Nonrodent (all allethrins except Bioallethrin)
21-day dermal (all allethrins)
90-day inhalation (reserved for all allethrins)

Chronic Toxicity

Rodent feeding (all allethrins except Pynamin-forte)
Nonrodent feeding (all allethrins except Bioallethrin)
Rat oncogenicity (all allethrins except Pynamin-forte)
Mouse oncogenicity (all allethrins)
Rat teratogenicity (all allethrins except Bioallethrin)
Rabbit teratogenicity (all allethrins)
Reproduction (all allethrins)

Mutagenicity

Gene mutation (Allethrin, Pynamin-forte, S-bioallethrin)
Chromosomal aberration (all allethrins)
Other mechanisms of mutagenicity (all allethrins except Bioallethrin)

Special Testing

Metabolism (all allethrins)

Ecological Effects

Avian reproduction
Field testing - mammals and birds (reserved pending reproduction data)
Freshwater fish LC_{50} (typical EP)
Freshwater aquatic invertebrate LC_{50} (typical EP)
Acute estuarine and marine LC_{50} (fish, shrimp, oyster)
Fish early life stage and invertebrate life cycle (freshwater, estuarine)
Fish life cycle
Field testing (aquatic organisms)

Environmental Fate

TIER I

DEGRADATION STUDIES - LAB
- Hydrolysis
- Photodegradation - water, soil, and air

METABOLISM STUDIES - LAB
- Aerobic metabolism (soil and aquatic)
- Anaerobic metabolism in soil

MOBILITY STUDIES
- Leaching/aged leaching
- Volatility (lab)

TIER II

Anaerobic aquatic metabolism	- Reserved
Volatility (field)	- Reserved
Field dissipation (soil)	- Reserved
Field dissipation (aquatic, sediment)	- Reserved
Field dissipation (soil, long-term)	- Reserved
Accumulation studies on rotational crops (confined)	- Reserved
Accumulation studies on rotational crops (field)	- Reserved
Accumulation studies on irrigated crops	- Reserved
Accumulation studies in fish	- Reserved
Accumulation studies in aquatic nontarget organisms	- Reserved
Reentry	- Reserved
Spray drift	- Reserved
Exposure	- Reserved

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Product Chemistry

Product Identity and Composition
Analysis and Certification of Product Ingredients
Physical and Chemical Characteristics

Residue Chemistry

Nature of the Residue (Metabolism) in Plant and Livestock
Residue Analytical Methods (may be required if additional metabolites of toxicological concern are identified)
Stability Data
Magnitude of Residue
  Crop field trials
  Postharvest treatment of fruits and vegetables
  Stored commodities
  Processing studies
  Meat/milk/poultry/eggs
  Food handling

7. CONTACT PERSON AT EPA

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